

CLAIMS

1. A reverse gate comprising:

a housing having a front opening and comprising first and second flow-reversing passages arranged on opposing sides thereof, each of said first and second flow-reversing passages having an inlet and a discharge opening, and a lateral steering passage located in a rear portion of said housing, said lateral steering passage having discharge openings at opposite ends thereof; and

a deflector body arranged inside said housing, said deflector body comprising a straight vertical wall and first and second curved vertical walls, each of said vertical walls being connected to a juncture, said straight vertical wall extending forward from said juncture, and said first and second curved vertical walls extending rearward and laterally outward from said junction, said first and second curved vertical walls extending along arcs on opposite sides of a plane which is generally co-planar with said straight vertical wall, the concave sides of said curved vertical walls generally facing said front opening and the convex sides of said curved vertical walls generally facing said lateral steering passage.

2. The reverse gate as recited in claim 1, wherein said deflector body is pivotably mounted to said housing.

3. The reverse gate as recited in claim 2, further comprising a pair of pivot pins coupled to said straight vertical wall for pivotably mounting said deflector body to said housing.

4. The reverse gate as recited in claim 2, wherein said deflector body pivots freely over a predetermined range of angles.

5. The reverse gate as recited in claim 1, wherein said straight vertical wall and said first curved vertical wall form a J shape.

5 6. The reverse gate as recited in claim 1, wherein said first and second curved vertical walls have shapes which mirror each other.

10 7. The reverse gate as recited in claim 1, wherein said housing comprises top and bottom walls connected by first and second curved outer walls on opposing sides thereof, forward portions of said first and second curved outer walls forming portions of said first and second flow-reversing passages respectively, and rear portions of said first and second curved outer walls partly forming said discharge openings of said lateral steering passage.

8. The reverse gate as recited in claim 7, wherein said first and second curved vertical walls have distal ends which do not contact said first and second curved outer walls respectively.

20 9. A reverse gate comprising:

25 a housing having a front opening and comprising first and second flow-reversing passages arranged on opposing sides thereof, each of said first and second flow-reversing passages having an inlet and a discharge opening, and a lateral steering passage located in a rear portion of said housing, said lateral steering passage having discharge openings at opposite ends thereof; and

30 a deflector body arranged inside said housing, said deflector body comprising first and second vertical surfaces, said first vertical surface extending straight from a first point adjacent said front opening to a second point located rearward of said first point and then curving along a first arc from said second point to a third point,

and said second vertical surface extending straight from a fourth point adjacent said front opening to a fifth point located rearward of said fourth point and then curving along a second arc from said fifth point to a sixth point, wherein said first and fourth points are separated by a thickness of a leading edge of said deflector body, said first and second arcs are equal to each other, and said third and sixth points are symmetrically located on opposing sides of a plane of symmetry defined by a plane midway between said straight portions of said first and second vertical surfaces.

10. The reverse gate as recited in claim 9, wherein the transitions from said straight portions to said curved portions at said second and fifth points are smooth.

11. The reverse gate as recited in claim 9, wherein said first and second arcs are each greater than 90 degrees.

12. The reverse gate as recited in claim 9, wherein said deflector body is pivotably mounted to said housing.

13. The reverse gate as recited in claim 12, further comprising a pair of pivot pins coupled to said deflector body along a section having said straight portions on opposing sides thereof.

14. The reverse gate as recited in claim 12, wherein said deflector body pivots freely over a predetermined range of angles.

15. The reverse gate as recited in claim 9, wherein each of said first and second vertical surfaces forms a J shape.

16. The reverse gate as recited in claim 9, wherein said housing comprises top and bottom walls

connected by first and second curved outer walls on  
opposing sides thereof, forward portions of said first  
and second curved outer walls forming portions of said  
first and second flow-reversing passages respectively,  
5 and rear portions of said first and second curved outer  
walls partly forming said discharge openings of said  
lateral steering passage.

17. The reverse gate as recited in claim 9,  
wherein a distal end of said curved portion of said first  
10 vertical surface is directed toward said inlet of said  
first flow-reversing passage, and a distal end of said  
curved portion of said second vertical surface is  
directed toward said inlet of said second flow-reversing  
passage.

18. A water jet propulsion system comprising:

a duct having an inlet and an outlet;

an impeller which is rotatable within said duct;

a steering nozzle pivotably mounted to an outlet  
end of said duct and having an inlet and an outlet, said  
20 steering nozzle being pivotable between first and second  
steering positions, and said steering nozzle inlet being in  
flow communication with said duct outlet; and

a reverse gate pivotably mounted to said duct,  
said reverse gate being pivotable about a pivot axis  
25 between first and second shift positions, said reverse gate  
in said first shift position being removed from the path of  
water exiting said steering nozzle outlet and in said  
second shift position being in the path of water exiting  
said steering nozzle outlet,

wherein said reverse gate comprises:

a housing having a front opening which faces said steering nozzle outlet when said reverse gate is in said second shift position, said housing comprising first and second flow-reversing passages arranged on opposing sides thereof, each of said first and second flow-reversing passages having an inlet and a discharge opening, and a lateral steering passage located in an aft portion of said housing, said lateral steering passage having discharge openings at opposite ends thereof; and

a deflector body arranged inside said housing, said deflector body comprising a straight vertical wall and first and second curved vertical walls, each of said vertical walls being connected to a juncture, said straight vertical wall extending forward from said juncture, and said first and second curved vertical walls extending rearward and laterally outward from said junction, said first and second curved vertical walls extending along arcs on opposite sides of a plane which is generally co-planar with said straight vertical wall, the concave sides of said curved vertical walls generally facing said front opening and the convex sides of said curved vertical walls generally facing said lateral steering passage.

19. The water jet propulsion system as recited in claim 18, wherein said deflector body is pivotably mounted to said housing.

20. The water jet propulsion system as recited in claim 19, wherein said deflector body pivots freely over a predetermined range of angles.

21. The water jet propulsion system as recited in claim 18, wherein said housing comprises top and bottom walls connected by first and second curved outer walls on opposing sides thereof, forward portions of said first and second curved outer walls forming portions of said first and second flow-reversing passages respectively,

and rear portions of said first and second curved outer walls partly forming said discharge openings of said lateral steering passage.

22. A water jet propulsion system comprising:

5 a duct having an inlet and an outlet;

an impeller which is rotatable within said duct;

10 a steering nozzle pivotably mounted to an outlet end of said duct and having an inlet and an outlet, said steering nozzle being pivotable between first and second steering positions, and said steering nozzle inlet being in flow communication with said duct outlet; and

15 a reverse gate pivotably mounted to said duct, said reverse gate being pivotable about a pivot axis between first and second shift positions, said reverse gate in said first shift position being removed from the path of water exiting said steering nozzle outlet and in said second shift position being in the path of water exiting said steering nozzle outlet, wherein said reverse gate comprises: a housing having a front opening which faces  
20 said steering nozzle outlet when said reverse gate is in said second shift position, said housing comprising first and second flow-reversing passages arranged on opposing sides thereof, each of said first and second flow-reversing passages having an inlet and a discharge opening, and a  
25 lateral steering passage located in an aft portion of said housing, said lateral steering passage having discharge openings at opposite ends thereof; and a deflector body pivotably mounted inside said housing.

30 23. The water jet propulsion system as recited in claim 22, wherein said deflector body pivots freely over a predetermined range of angles.

24. The water jet propulsion system as recited in claim 22, wherein said deflector body comprises a straight vertical wall and first and second curved vertical walls, each of said vertical walls being connected to a juncture, said straight vertical wall extending forward from said juncture, and said first and second curved vertical walls extending rearward and laterally outward from said junction, said first and second curved vertical walls extending along arcs on opposite sides of a plane which is generally co-planar with said straight vertical wall, the concave sides of said curved vertical walls generally facing said front opening and the convex sides of said curved vertical walls generally facing said lateral steering passage.

25. The water jet propulsion system as recited in claim 22, wherein said deflector body comprises first and second vertical surfaces, said first vertical surface extending straight from a first point adjacent said front opening to a second point located rearward of said first point and then curving along a first arc from said second point to a third point, and said second vertical surface extending straight from a fourth point adjacent said front opening to a fifth point located rearward of said fourth point and then curving along a second arc from said fifth point to a sixth point, wherein said first and fourth points are separated by a thickness of a leading edge of said deflector body, said first and second arcs are equal to each other, and said third and sixth points are symmetrically located on opposing sides of a plane of symmetry defined by a plane midway between said straight portions of said first and second vertical surfaces.

26. A water jet propulsion system comprising:

a duct having an inlet and an outlet;

an impeller which is rotatable within said duct;

a steering nozzle pivotably mounted to an outlet end of said duct and having an inlet and an outlet, said steering nozzle being pivotable between first and second steering positions, and said steering nozzle inlet being in flow communication with said duct outlet; and

a reverse gate pivotably mounted to said duct, said reverse gate being pivotable about a pivot axis between first and second shift positions, said reverse gate in said first shift position being removed from the path of water exiting said steering nozzle outlet and in said second shift position being in the path of water exiting said steering nozzle outlet,

wherein said reverse gate comprises:

a housing having a front opening which faces said steering nozzle outlet when said reverse gate is in said second shift position, said housing comprising first and second flow-reversing passages arranged on opposing sides thereof, each of said first and second flow-reversing passages having an inlet and a discharge opening, and a lateral steering passage located in an aft portion of said housing, said lateral steering passage having discharge openings at opposite ends thereof; and

a deflector body mounted inside said housing, said deflector body comprising first and second vertical surfaces, said first vertical surface extending straight from a first point adjacent said front opening to a second point located rearward of said first point and then curving along a first arc from said second point to a third point, and said second vertical surface extending straight from a fourth point adjacent said front opening to a fifth point located rearward of said fourth point and then curving along a second arc from said fifth point to a sixth point, wherein said first and fourth points are separated by a thickness of a leading edge of said deflector body, said



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first and second arcs are equal to each other, and said  
third and sixth points are symmetrically located on  
opposing sides of a plane of symmetry defined by a plane  
midway between said straight portions of said first and  
5 second vertical surfaces.